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PATENT ABSTRACTS OF JAPAN

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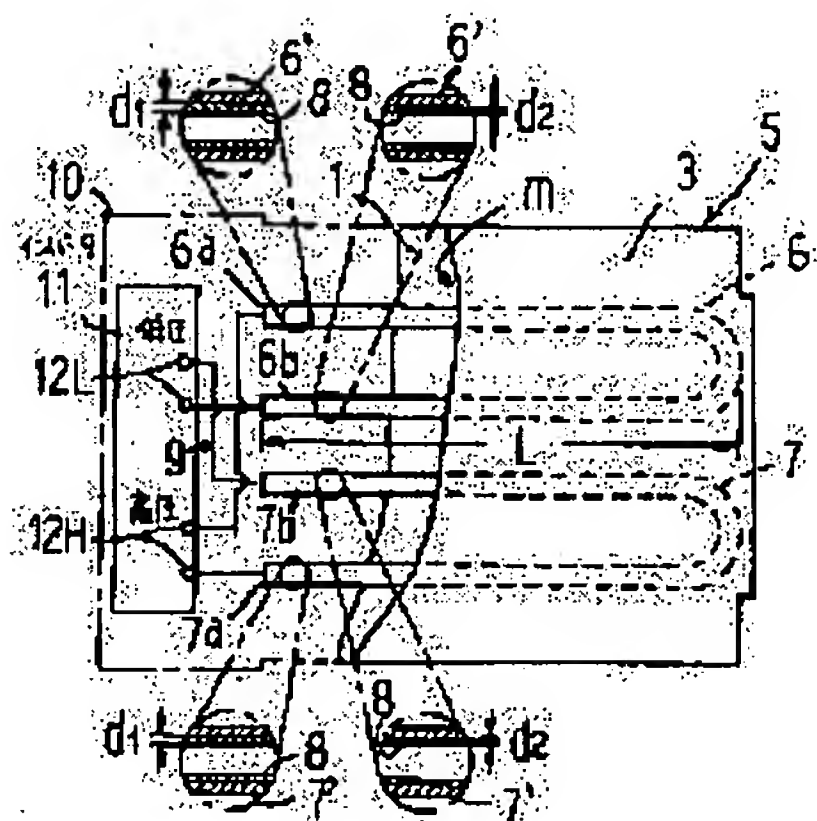
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(54) BACKLIGHT UNIT

(57)Abstract:

PURPOSE: To provide a backlight unit such as a liquid crystal display panel improved in luminance uniformity by lessening luminance dispersion right over both ends of a U-shaped fluorescent lamp.

CONSTITUTION: Electrodes at the outside ends 6a, 7a of two U-shaped fluorescent lamps 6, 7, respectively, arranged in parallel right under a rectangular diffusing plate 3 are wired to the output terminal 12H on the high voltage side of an inverter circuit 11, while electrodes at the inside ends 6b, 7b are wired to the output terminal 12L on the low voltage side of the inverter circuit 11. The thickness of fluorescent coats 8 at the outside ends 6a, 7a of the fluorescent lamp 6, 7 is greater than that at the inside ends 6b, 7b. When the fluorescent lamps 6, 7 are lit via the inverter circuit, the luminance of the outside ends 6a, 7a having more thickness and high voltage surely increases, the luminance of the center and periphery areas on the diffusing plate 3 are well-balanced and luminance uniformity is improved to 85% or more in total.



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CLAIMS

[Claim(s)]

[Claim 1] In the back light unit arrange [unit] two or more U form fluorescent lamps to juxtaposition at intervals of predetermined, and it was made to make the flat lamp space formed with the reflecting plate and the penetrable diffusion plate turn on each fluorescent lamp by the inverter circuit When impressing high-frequency voltage to the electrode of the both ends of a fluorescent lamp and carrying out RF burning of the fluorescent lamp, said inverter circuit It has the high-tension side output terminal from which output voltage compares with a grand level, and turns into high voltage, and a low-battery side output terminal. The back light unit characterized by wiring the high-tension side output terminal of an inverter circuit in the electrode of the outside edge of the fluorescent lamp located in the both ends of the fluorescent lamp array direction of said lamp space.

[Claim 2] In the back light unit arrange [unit] two or more U form fluorescent lamps to juxtaposition at intervals of predetermined in the flat lamp space formed with the reflecting plate and the penetrable diffusion plate, and it was made to make each fluorescent lamp turn on by the inverter circuit Said two or more fluorescent lamps of each are back light units with which the thickness of the fluorescent substance coat formed in the glass tube inner skin of the both ends carries out a size difference, and the outside edge of the fluorescent lamp located in the both ends of the fluorescent lamp array direction of said lamp space is characterized by being an edge by the side of the thickness size of a fluorescent substance coat.

[Claim 3] In the back light unit arrange [unit] two or more U form fluorescent lamps to juxtaposition at intervals of predetermined in the flat lamp space formed with the reflecting plate and the penetrable diffusion plate, and it was made to make each fluorescent lamp turn on by the inverter circuit When impressing high-frequency voltage to the electrode of the * NOTICES * □a fluorescent lamp and carrying out RF burning of the fluorescent lamp, said inverter circuit It has the high-tension side output terminal from which output voltage compares with a grand level, and turns into high voltage, and a low-battery side output terminal. The outside edge of the fluorescent lamp with which the thickness of the fluorescent substance coat formed in the glass tube inner skin of the both ends carries out a size difference, and is located in the both ends of the fluorescent lamp array direction of said lamp space said two or more fluorescent lamps of each at the edge by the side of the thickness size of a fluorescent substance coat And the back light unit characterized by the electrode of this outside edge being wired by the high-tension side output terminal of an inverter circuit.

[Claim 4] The back light unit according to claim 1 to 3 with which two or more U form fluorescent lamps are characterized by being the cold cathode mold fluorescent lamp whose tube diameter is 2.5-5mm.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the back light unit for liquid crystal display panels used for a liquid crystal television etc.

[0002]

[Description of the Prior Art] The back light of a liquid crystal display panel is put in practical use from the back light unit of the rectangle thin form which used the long and slender fluorescent lamp for the light source being a low power by high brightness. The conventional example of this back light unit is explained with reference to drawing 4 and drawing 5.

[0003] The back light unit shown in this drawing is a back light unit for direct female mold 2 LGTs which has arranged two U form fluorescent lamps 6 and 7 to the lamp space m in the flat lamp house 5 formed with the rectangle dished reflecting plate 1 and the rectangular penetrable diffusion plate 3. Each fluorescent lamps 6 and 7 are the things of the same structure, are used as a reflecting plate 1 at parallel, and are arranged at intervals of predetermined at juxtaposition. The reflective sheet 2 is stuck on what a reflecting plate 1 turns the light of fluorescent lamps 6 and 7 to the diffusion plate 3, reflects, and performed white paint to the aluminum plate, for example, stuck the reflective sheets 2, such as a silver vacuum evaporation sheet, on the painted surface, and a resin plate. The diffusion plate 3 is an acrylic resin plate which is made to diffuse the light of fluorescent lamps 6 and 7, and is made to penetrate, and the electric conduction sheet 4 which prevents leakage of the radiation noise at the time of fluorescent lamp burning if needed is stuck on the rear face of this.

[0004] The circuit housing 10 is connected with the piece edge of a lamp house 5, and the inverter circuit 11 which carries out high frequency burning of the fluorescent lamps 6 and 7 into the circuit housing 10 is contained. Although an inverter circuit 11 does not illustrate, it consists of an oscillation transformer, two or more oscillation transistors, etc., and the electrode (not shown) of the both ends of two fluorescent lamps 6 and 7 is connected to each of the output terminal 12 which is four to which high-frequency voltage is impressed with lead wire 9.

[0005] If RF burning of the fluorescent lamps 6 and 7 is carried out by the inverter circuit 11, directly, the remainder reflects a reflecting plate 1 and goes into the diffusion plate 3, it will be spread with the diffusion plate 3, optical distribution will be equalized, and a part of the light will penetrate it, and it will irradiate the liquid crystal display panel on the diffusion plate 3 (not shown).

[0006]

[Problem(s) to be Solved by the Invention] The long and slender thing whose tube diameter is 2.5-5mm is used, and, as for the fluorescent lamps 6 and 7 which a thing also with a thin back light unit like drawing 4 is required by thin form-ization of a liquid crystal display panel, and are used for the light source from this demand, the inverter circuit 11 with an easy miniaturization is applied to the burning means of this. Although the uniform thing of the brightness on the diffusion plate 3 when carrying out inverter burning of such fluorescent lamps 6 and 7 is desirable the whole region on the diffusion plate 3, it is in the inclination for the brightness of the center section of the diffusion plate 3 to be high, for the brightness of the periphery of the diffusion plate 3 to become low, and for the brightness in the part of the outside edge of two fluorescent lamps 6 and 7 to become low especially. The luminance distribution in the fluorescent lamp array direction on the diffusion plate 3 is high in the center section of the diffusion plate 3, as shown in drawing 6, it becomes low at both ends, and is actually in the inclination for the brightness regularity of the whole diffusion plate 3 to vary with a product.

[0007] Although the degree of dispersion in the brightness of a center section and the both ends on such a diffusion plate 3 also has the case of extent which does not become a problem as a back light of a liquid crystal display panel, may become a problem and the actual condition is that it is not stable. Moreover, the actual condition is that the inclination for the degree of dispersion in the brightness of a center section and the both ends on the diffusion plate 3 to pose a problem is increasing with quality improvement of a liquid crystal display panel in recent years.

[0008] The place made into the object of this invention is to offer the back light unit for fluorescent lamps which can improve the degree of dispersion in the brightness of a center section and the periphery of a diffusion plate.

[0009]

[Means for Solving the Problem] In the back light unit this invention arranges [unit] two or more U form fluorescent lamps to juxtaposition at intervals of predetermined in the flat lamp space formed with the reflecting plate and the penetrable diffusion plate, and it was made to make each fluorescent lamp turn on by the inverter circuit The electrode of the outside edge of the fluorescent lamp located in the both ends of the fluorescent lamp array direction of lamp space Rather than the

electrode of other inside edges of this fluorescent lamp, constitute, and the high-tension side output terminal of the inverter circuit which impresses high tension is connected and attained to. Or thickness of the fluorescent substance coat formed in the glass tube of the outside edge of the fluorescent lamp located in the both ends of the fluorescent lamp array direction of lamp space is characterized by constituting so that it may become larger than the thickness of the fluorescent substance coat in other inside edges of this fluorescent lamp.

[0010]

[Function] this invention person could know the following two things, as a result of pursuing the cause of dispersion generating of the brightness of the both-ends right above of U form fluorescent lamp of the direct female mold back light unit of a liquid crystal display panel by experiment. That is, it turned out that a difference is in the high-frequency voltage impressed to the electrode of the both ends of the fluorescent lamp turned on by the inverter circuit, and it is in the inclination for the brightness right above the piece edge of the fluorescent lamp of a side with the electrode with which high tension is comparatively impressed with a grand level to become higher than the brightness right above other edges of the fluorescent lamp of a side with the electrode with which a low battery is impressed comparatively. Moreover, although the fluorescent substance coat of a fluorescent lamp poured and applied fluorescent substance suspension to glass tube inner skin, it was made to dry and this was calcinated and formed, when a difference arises in the thickness of the fluorescent substance coat of ends circles of a glass tube with this formation process and the fluorescent lamp was made to turn on, it also turned out that there is an inclination for an edge with the larger thickness of a fluorescent substance coat to become brighter than an edge with smaller thickness.

[0011] When the above two inclinations arrange easily two or more [of U form fluorescent lamp which a tube diameter is strongly seen in 5mm or less and a long and slender cold cathode mold fluorescent lamp, and is in such an inclination] to the flat lamp space between a reflecting plate and a diffusion plate and wire easily at an inverter circuit, dispersion which poses a problem may occur in the brightness on a center section and the both ends of the above-mentioned diffusion plate. Then, if it is made for the near edge where the high tension of two U form fluorescent lamps of the outside of two or more U form fluorescent lamps arranged at juxtaposition is impressed to lamp space to become the location of the both ends of the lamp array direction of lamp space, the brightness of the both ends of the diffusion plate corresponding to these both ends can be set up highly. Or if it is made for an edge with the larger thickness of the fluorescent substance coat of two U form fluorescent lamps of the outside of two or more U form fluorescent lamps arranged in lamp space at juxtaposition to become the location of the both ends of the lamp array direction of lamp space, the brightness of the both ends of the diffusion plate corresponding to these both ends can be set up highly. Furthermore, if the high tension of two U form fluorescent lamps of the outside of two or more U form fluorescent lamps arranged at juxtaposition is impressed to lamp space and it is made for an edge with the larger thickness of a fluorescent substance coat to become the location of the both ends of the lamp array direction of lamp space, the brightness of the both ends of the diffusion plate corresponding to these both ends can set up still still more highly.

[0012] If two or more U form fluorescent lamps have been arranged to lamp space flat as mentioned above, it will have been recognized that **** in the part which carried out the brightness rise in the both ends of the lamp array direction of a diffusion plate, the brightness of a center section is downed, the brightness of a center section and the periphery on a diffusion plate is balanced as a result, and the brightness regularity on [whole] a diffusion plate improves certainly.

[0013]

[Example] Hereafter, an example is explained with reference to drawing 1 thru/or drawing 3 . In addition, the same sign is given to the same or a considerable part through the complete diagram containing drawing 4 thru/or drawing 6 , and explanation is omitted.

[0014] The back light unit shown in drawing 1 is a thing same type as drawing 4 , and is characterized by the array gestalt of two U form fluorescent lamps 6 and 7 arranged in the lamp space m formed with the reflecting plate 1 and the diffusion plate 3 at juxtaposition, and the wiring gestalt of the inverter circuit 11 contained by these U form fluorescent lamps 6 and 7 and the circuit housing 10.

[0015] Two fluorescent lamps 6 and 7 are the same structures, it has the fluorescent substance coat 8 in the inner skin of 7', an electrode (not shown) is enclosed with the ends circles of each fluorescent lamps 6 and 7, and, as for each fluorescent lamps 6 and 7, U form glass tube 6' and the lead wire 9 drawn from each of this electrode outside are connected to the output terminal 12 to which an inverter circuit 11 corresponds. The output terminal 12 of an inverter circuit 11 consists of one pair each of output terminal 12L set to output terminal 12H which become a high-tension side with a grand level as compared with the time of carrying out inverter burning of each fluorescent lamps 6 and 7 a low-battery side. A pair each of output terminals 12H and 12L with this electrical-potential-difference difference are decided with wiring with the oscillation transformer (not shown) in an inverter circuit 11. In addition, output terminals 12H and 12L can also be directly connected with an inverter circuit, without also being able to substitute a socket and using a special terminal. The output terminal in this invention shall contain such a thing.

[0016] If each fluorescent lamps 6 and 7 are easily connected to an inverter circuit 11 temporarily now regardless of the size of the voltage level impressed to the electrode of the both ends of each and inverter burning is carried out, it turns out that it is in the inclination for the luminance distribution of the lamp array direction on the diffusion plate 3 to become unstable as a result. Moreover, the instability of such luminance distribution is also understood that it is in the inclination been [an inclination / it] conspicuous and generated in the long and slender cold cathode mold fluorescent lamp of about 2.5-5mm of tube diameters suitable for the light source of the back light of a liquid crystal display panel.

[0017] Then, in this invention, the electrode of the edges 6a and 7a of each outside of two U form fluorescent lamps 6 and 7

arranged in the lamp space m at juxtaposition is connected to output terminal 12H the high-tension side of an inverter circuit 11, the electrode of the edges 6b and 7b inside [each] U form fluorescent lamps 6 and 7 is connected to low-battery side output terminal 12L of an inverter circuit 11, and inverter burning is carried out. Then, it turned out in the experiment that it is in the inclination for the brightness of the outside edges 6a and 7a of the side connected to output terminal 12H the high-tension side of each fluorescent lamps 6 and 7 to become higher than the brightness of the inside edges 6b and 7b connected to low-battery side output terminal 12L.

[0018] It has with the above fluorescent lamps 6 and 7 and wiring of an inverter circuit 11. The brightness of both ends with the outside edges 6a and 7a of the fluorescent lamps 6 and 7 on the diffusion plate 3 rises certainly, ****s in a part for this rise, and the brightness of the center section of the diffusion plate 3 is downed. It turns out that the brightness of a center section and the both ends of the diffusion plate 3 is balanced as a result, and the brightness regularity on [whole] the diffusion plate 3 [(the minimum brightness / the maximum brightness) x100] is stabilized at 85% or more like the experimental data mentioned later.

[0019] Moreover, this invention uses the size of the thickness of the fluorescent substance coat of the both ends 6a, 6b, 7a, and 7b of two U form fluorescent lamps 6 and 7. namely, thickness d1 of the fluorescent substance coat 8 of piece edge 6a of one fluorescent lamp 6 Thickness d2 of the fluorescent substance coat 8 of other end 6b **** -- there is some difference. This thickness difference is produced in the phase which forms the fluorescent substance coat 8 in the inner skin of glass tube 6'. For example, although stand the straight pipe form glass tube of ends opening to a vertical, slush fluorescent substance suspension from on the, apply to a glass tube inner surface, this is dried, it calcinates and fluorescent substance coat formation is performed When drying the fluorescent substance suspension applied in the glass tube, fluorescent substance suspension drips and gets down from a perpendicular glass tube inner surface by self-weight, the amount of the fluorescent substance suspension of the glass tube lower part increases at this time, and the thickness of the fluorescent substance coat formed in the glass tube lower part is in the inclination which becomes larger than the thickness of the glass tube upper part. the same -- thickness d1 of the fluorescent substance coat 8 of piece edge 7a of other fluorescent lamps 7 Thickness d2 of the fluorescent substance coat 8 of other end 7b **** -- [0020] with some difference In addition, although usually spontaneously generated on the above fluorescent substance coat formation processes, you may make it the difference of the thickness d1 and d2 of the fluorescent substance coat 8 in the both ends 6a, 6b, 7a, and 7b of such fluorescent lamps 6 and 7 form a fluorescent substance coat positively so that the difference of thickness d1 and d2 may arise in the predetermined range.

[0021] When it has arranged easily and the lamp space m is made to carry out inverter burning of the two U form fluorescent lamps 6 and 7, without taking into consideration the thickness difference of the fluorescent substance coat in each of that edge, it turns out that it is in the inclination for the luminance distribution of the lamp array direction on the diffusion plate 3 to become unstable as a result. The instability of such luminance distribution is also understood that it is in the inclination been [an inclination / it] conspicuous and generated in the long and slender cold cathode mold fluorescent lamp of about 2.5-5mm of tube diameters suitable for the light source of the back light of a liquid crystal display panel.

[0022] You make it located in the both ends of the lamp space m, and it arranges here so that the edges 6a and 7a of the thickness size of two U form fluorescent lamps 6 and 7 may turn into an outside edge in this invention. When inverter burning of these fluorescent lamps 6 and 7 was carried out, it turned out in the experiment that it is in the inclination for the brightness of the edges 6a and 7a of the thickness size of each fluorescent lamps 6 and 7 to become higher than the brightness of the edges 6b and 7b of thickness smallness. Moreover, the brightness of the both ends which have the edges 6a and 7a of the thickness size of the fluorescent lamps 6 and 7 on the diffusion plate 3 as arrangement of the fluorescent lamps 6 and 7 in such lamp space m is also rises certainly, ****s in a part for this rise, the brightness of the center section of the diffusion plate 3 is downed, the brightness of a center section and the both ends of the diffusion plate 3 is balanced as a result, and the brightness regularity on [whole] the diffusion plate 3 is stabilized in altitude.

[0023] The back light unit shown in drawing 1 Outside edge 6a of U form fluorescent lamps 6 and 7 of 2 juxtaposition, The fluorescent substance coat 8 of 7a is thickness size, and the electrode of these outside edges 6a and 7a is connected to output terminal 12H the high-tension side of an inverter circuit 11. The fluorescent substance coat 8 of the inside edges 6b and 7b is thickness smallness, among these the electrode of the side edge sections 6b and 7b is connected to low-battery side output terminal 12L of an inverter circuit 11. Consequently, outside edge 6a by the side of the high tension of the fluorescent lamps 6 and 7 on the diffusion plate 3, and thickness size, As the brightness of both ends with 7a becomes still still higher by the brightness rise effectiveness by the above-mentioned high tension and thickness size, it is balanced still more nearly further in the brightness of the center section of the diffusion plate 3 and it is shown in drawing 2 It has been recognized by the experiment that the brightness of the lamp array direction on the diffusion plate 3 is equalized, and the whole brightness regularity is stabilized more in altitude.

[0024] In addition, in order to prevent the wiring mistake which makes a mistake in the edges 6a and 7a of the thickness size of fluorescent lamps 6 and 7 to low-battery side output terminal 12L of an inverter circuit 11, and is connected at the time of the wiring assembly of the back light unit of the example of drawing 1 , it is good even if as follows. For example, this edge attaches visually etc. the thickness display means which is not illustrated [tape / the coating which can carry out a judgment check as it is the thickness large side edge section, and by which marking was carried out,] to the front face of the edges 6a and 7a of the thickness size of fluorescent lamps 6 and 7. And if the thickness display means of fluorescent lamps 6 and 7 is checked visually, or the directivity of the edge of each fluorescent lamps 6 and 7 is set to accuracy by detecting automatically by the sensor and it is made to wire an inverter circuit 11, the above-mentioned wiring mistake will be prevented.

[0025] The example of the back light unit of drawing 1 and the example of an experiment are explained. The cold cathode

mold fluorescent lamp whose die-length L from an edge to a flection is 135mm is used for two U form fluorescent lamps 6 and 7 by 3mm of tube diameters, the back light unit of the 6 inch screen whose height of a lamp house 5 is 10mm is constituted, and inverter burning of the fluorescent lamps 6 and 7 is carried out with the high-frequency voltage of 45kHz. the effective luminescence area part on the diffusion plate 3 of this back light unit -- drawing 3 -- be shown -- two conventional examples which have arranged easily the same fluorescent lamps 6 and 7 as the experimental data of the result of having divided the 9th grade in the shape of a grid, and having measured the brightness of each partition region of ** in divided drawing - **, in a lamp house 5 are shown in a table 1.

[0026]

[A table 1]

輝度 [Cd/m²]、均斉度 [輝度最大/輝度最小]

測定点	従来例 1	従来例 2	本発明
①	8320	8530	8780
②	8920	7130	7170
③	5810	5890	6430
④	7820	7730	7170
⑤	8120	7950	7520
⑥	7630	7500	8500
⑦	6580	8730	8870
⑧	8810	8900	7400
⑨	5530	5750	6530
均斉度 %	68.1	72.3	85.5

[0027] According to the experimental data of a table 1, it turns out that the brightness of the lamp array direction on the diffusion plate 3 in the back light unit of this invention is equalized, and the brightness regularity of the diffusion plate 3 whole improves from conventional 70% order to 85% or more. The brightness of center-section ** by the side of the edge of U form fluorescent lamps 6 and 7 of the diffusion plate 3 in the conventional example For example, 7630 Cd/m², 7500 Cd/m² it was -- a thing -- 6500 Cd/m² While falling for a while The brightness of both-ends [of center-section **] ** and ** of the **s 5810 Cd/m² of the conventional example, 5530 Cd/m² to 6430 Cd/m² going up -- the brightness of ** -- 5530 Cd/m² and 5750 Cd/m² from -- 6530 Cd/m² It turns out that it goes up and the brightness of the lamp array direction on the diffusion plate 3 is balanced. Moreover, such brightness regularity is known by that 85% or more of back light unit is effective as a back light of a high quality liquid crystal display panel.

[0028] In addition, this invention is applied also in the direct female mold back light unit which used three or more of U form fluorescent lamp. What is necessary is just to apply the technical content of the above-mentioned example about two fluorescent lamps of both ends in the back light unit arranged to juxtaposition in the lamp space where U form fluorescent lamp is [three] flat.

[0029]

[Effect of the Invention] According to this invention, the brightness in the both ends of the lamp array direction on a diffusion plate goes up even to the value balanced in the brightness of the center section of the diffusion plate certainly, improvement-izing and stabilization of the brightness regularity of the diffusion plate whole region are attained, and a back light unit suitable as a back light of a high quality liquid crystal display panel can be offered. Moreover, it can carry out that this invention is also for management of the thickness of the wiring gestalt of a fluorescent lamp and an inverter circuit, and the fluorescent substance coat of a fluorescent lamp, and the advantageous back light unit in plant-and-equipment investment which can use an existing fluorescent lamp manufacturing facility and an existing back light unit assembly line as it is can be offered.

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TECHNICAL FIELD

[Industrial Application] This invention relates to the back light unit for liquid crystal display panels used for a liquid crystal television etc.

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PRIOR ART

[Description of the Prior Art] The back light of a liquid crystal display panel is put in practical use from the back light unit of the rectangle thin form which used the long and slender fluorescent lamp for the light source being a low power by high brightness. The conventional example of this back light unit is explained with reference to drawing 4 and drawing 5.

[0003] The back light unit shown in this drawing is a back light unit for direct female mold 2 LGTs which has arranged two U form fluorescent lamps 6 and 7 to the lamp space m in the flat lamp house 5 formed with the rectangle dished reflecting plate 1 and the rectangular penetrable diffusion plate 3. Each fluorescent lamps 6 and 7 are the things of the same structure, are used as a reflecting plate 1 at parallel, and are arranged at intervals of predetermined at juxtaposition. The reflective sheet 2 is stuck on what a reflecting plate 1 turns the light of fluorescent lamps 6 and 7 to the diffusion plate 3, reflects, and performed white paint to the aluminum plate, for example, stuck the reflective sheets 2, such as a silver vacuum evaporation sheet, on the painted surface, and a resin plate. The diffusion plate 3 is an acrylic resin plate which is made to diffuse the light of fluorescent lamps 6 and 7, and is made to penetrate, and the electric conduction sheet 4 which prevents leakage of the radiation noise at the time of fluorescent lamp burning if needed is stuck on the rear face of this.

[0004] The circuit housing 10 is connected with the piece edge of a lamp house 5, and the inverter circuit 11 which carries out high frequency burning of the fluorescent lamps 6 and 7 into the circuit housing 10 is contained. Although an inverter circuit 11 does not illustrate, it consists of an oscillation transformer, two or more oscillation transistors, etc., and the electrode (not shown) of the both ends of two fluorescent lamps 6 and 7 is connected to each of the output terminal 12 which is four to which high-frequency voltage is impressed with lead wire 9.

NOTICES * □ burning of the fluorescent lamps 6 and 7 is carried out by the inverter circuit 11, directly, the remainder reflect a reflecting plate 1 and goes into the diffusion plate 3, it will be spread with the diffusion plate 3, optical distribution will be equalized, and a part of the light will penetrate it, and it will irradiate the liquid crystal display panel on the diffusion plate 3 (not shown).

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the brightness in the both ends of the lamp array direction on a diffusion plate goes up even to the value balanced in the brightness of the center section of the diffusion plate certainly, improvement-izing and stabilization of the brightness regularity of the diffusion plate whole region are attained, and a back light unit suitable as a back light of a high quality liquid crystal display panel can be offered. Moreover, it can carry out that this invention is also for management of the thickness of the wiring gestalt of a fluorescent lamp and an inverter circuit, and the fluorescent substance coat of a fluorescent lamp, and the advantageous back light unit in plant-and-equipment investment which can use an existing fluorescent lamp manufacturing facility and an existing back light unit assembly line as it is can be offered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The long and slender thing whose tube diameter is 2.5-5mm is used, and, as for the fluorescent lamps 6 and 7 which a thing also with a thin back light unit like drawing 4 is required by thin form-ization of a liquid crystal display panel, and are used for the light source from this demand, the inverter circuit 11 with an easy miniaturization is applied to the burning means of this. Although the uniform thing of the brightness on the diffusion plate 3 when carrying out inverter burning of such fluorescent lamps 6 and 7 is desirable the whole region on the diffusion plate 3, it is in the inclination for the brightness of the center section of the diffusion plate 3 to be high, for the brightness of the periphery of the diffusion plate 3 to become low, and for the brightness in the part of the outside edge of two fluorescent lamps 6 and 7 to become low especially. The luminance distribution in the fluorescent lamp array direction on the diffusion plate 3 is high in the center section of the diffusion plate 3, as shown in drawing 6, it becomes low at both ends, and is actually in the inclination for the brightness regularity of the whole diffusion plate 3 to vary with a product.

[0007] Although the degree of dispersion in the brightness of a center section and the both ends on such a diffusion plate 3 also has the case of extent which does not become a problem as a back light of a liquid crystal display panel, may become a problem and the actual condition is that it is not stable. Moreover, the actual condition is that the inclination for the degree of dispersion in the brightness of a center section and the both ends on the diffusion plate 3 to pose a problem is increasing with quality improvement of a liquid crystal display panel in recent years.

[0008] The place made into the object of this invention is to offer the back light unit for fluorescent lamps which can improve the degree of dispersion in the brightness of a center section and the periphery of a diffusion plate.

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MEANS

[Means for Solving the Problem] In the back light unit this invention arranges [unit] two or more U form fluorescent lamps to juxtaposition at intervals of predetermined in the flat lamp space formed with the reflecting plate and the penetrable diffusion plate, and it was made to make each fluorescent lamp turn on by the inverter circuit The electrode of the outside edge of the fluorescent lamp located in the both ends of the fluorescent lamp array direction of lamp space Rather than the electrode of other inside edges of this fluorescent lamp, constitute, and the high-tension side output terminal of the inverter circuit which impresses high tension is connected and attained to. Or thickness of the fluorescent substance coat formed in the glass tube of the outside edge of the fluorescent lamp located in the both ends of the fluorescent lamp array direction of lamp space is characterized by constituting so that it may become larger than the thickness of the fluorescent substance coat in other inside edges of this fluorescent lamp.

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OPERATION

[Function] this invention person could know the following two things, as a result of pursuing the cause of dispersion generating of the brightness of the both-ends right above of U form fluorescent lamp of the direct female mold back light unit of a liquid crystal display panel by experiment. That is, it turned out that a difference is in the high-frequency voltage impressed to the electrode of the both ends of the fluorescent lamp turned on by the inverter circuit, and it is in the inclination for the brightness right above the piece edge of the fluorescent lamp of a side with the electrode with which high tension is comparatively impressed with a grand level to become higher than the brightness right above other edges of the fluorescent lamp of a side with the electrode with which a low battery is impressed comparatively. Moreover, although the fluorescent substance coat of a fluorescent lamp poured and applied fluorescent substance suspension to glass tube inner skin, it was made to dry and this was calcinated and formed, when a difference arises in the thickness of the fluorescent substance coat of ends circles of a glass tube with this formation process and the fluorescent lamp was made to turn on, it also turned out that there is an inclination for an edge with the larger thickness of a fluorescent substance coat to become brighter than an edge with smaller thickness.

[0011] When the above two inclinations arrange easily two or more [of U form fluorescent lamp which a tube diameter is strongly seen in 5mm or less and a long and slender cold cathode mold fluorescent lamp, and is in such an inclination] to the flat lamp space between a reflecting plate and a diffusion plate and wire easily at an inverter circuit, dispersion which poses a problem may occur in the brightness on a center section and the both ends of the above-mentioned diffusion plate. Then, if it is made for the near edge where the high tension of two U form fluorescent lamps of the outside of two or more U form fluorescent lamps arranged at juxtaposition is impressed to lamp space to become the location of the both ends of the lamp array direction of lamp space, the brightness of the both ends of the diffusion plate corresponding to these both ends can be set up highly. Or if it is made for an edge with the larger thickness of the fluorescent substance coat of two U form fluorescent lamps of the outside of two or more U form fluorescent lamps arranged in lamp space at juxtaposition to become the location of the both ends of the lamp array direction of lamp space, the brightness of the both ends of the diffusion plate corresponding to these both ends can be set up highly. Furthermore, if the high tension of two U form fluorescent lamps of the outside of two or more U form fluorescent lamps arranged at juxtaposition is impressed to lamp space and it is made for an edge with the larger thickness of a fluorescent substance coat to become the location of the both ends of the lamp array direction of lamp space, the brightness of the both ends of the diffusion plate corresponding to these both ends can set up still still more highly.

[0012] If two or more U form fluorescent lamps have been arranged to lamp space flat as mentioned above, it will have been recognized that **** in the part which carried out the brightness rise in the both ends of the lamp array direction of a diffusion plate, the brightness of a center section is downed, the brightness of a center section and the periphery on a diffusion plate is balanced as a result, and the brightness regularity on [whole] a diffusion plate improves certainly.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The top view showing the example of the back light unit concerning this invention which contains an abbreviation part and a partial enlarged section in part.

[Drawing 2] The brightness distribution map of the fluorescent lamp edge right above of the drawing 1 back light unit.

[Drawing 3] The top view when dividing the 9th grade for luminance distribution measurement of the effective luminescence side of the drawing 1 back light unit.

[Drawing 4] The conventional back light unit is a top view containing an abbreviation part a part.

[Drawing 5] The sectional view which meets the drawing 4 A-A line.

[Drawing 6] The brightness distribution map of the fluorescent lamp edge right above of the drawing 4 back light unit.

[Description of Notations]

1 Reflecting Plate

3 Diffusion Plate

m Lamp space

6 U Form Fluorescent Lamp

6a The edge by the side of thickness size

6b The edge by the side of thickness smallness

7 U Form Fluorescent Lamp

7a The edge by the side of thickness size

7b The edge by the side of thickness smallness

6' Glass tube

7' Glass tube

8 Fluorescent Substance Coat

11 Inverter Circuit

12H High-tension side output terminal

12L Low-battery side output terminal

[Translation done.]

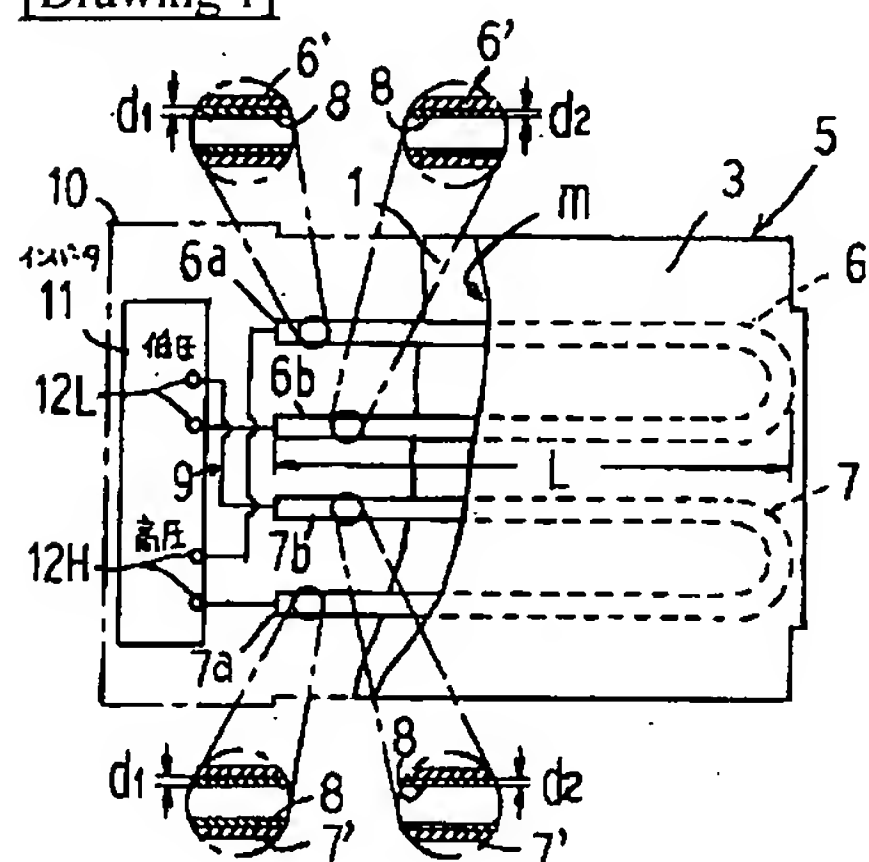
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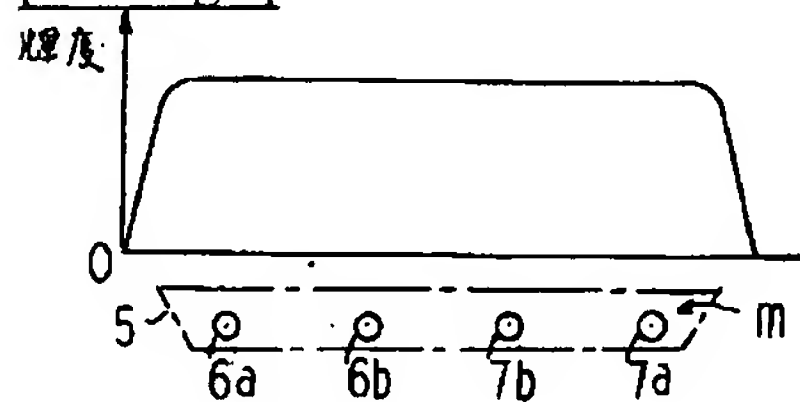
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DRAWINGS

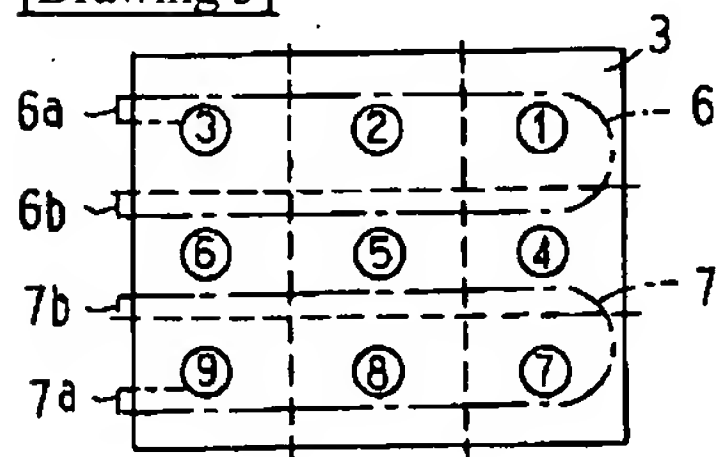
[Drawing 1]



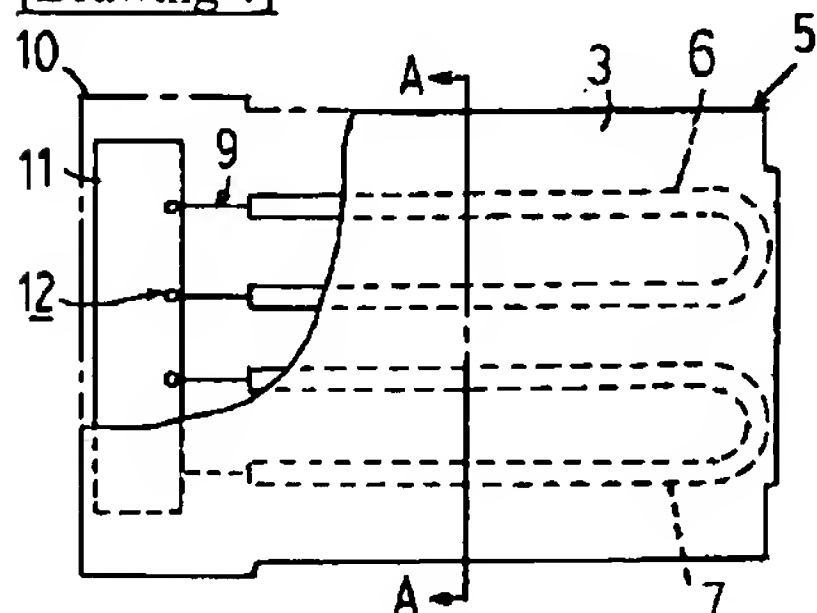
[Drawing 2]



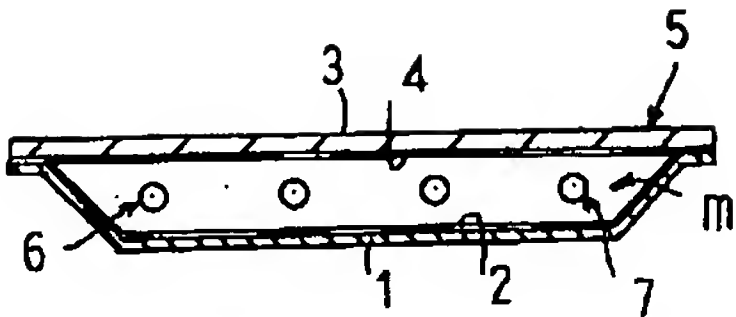
[Drawing 3]



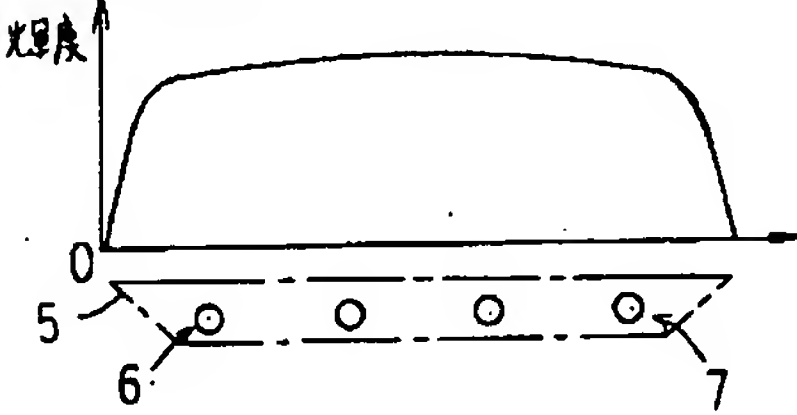
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]